

# HYDROGEN AND FUEL CELLS

AN UPDATE FROM EUROPE, INCLUDING THE UK

A presentation for the 7<sup>th</sup> FC International meeting, organised by FCS & FCDIC. February 26<sup>th</sup> 2019, Tokyo.

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# Agenda

An update from Europe, including the UK

1. Introduction to Delta-ee
2. The European micro-CHP market: an update
3. Hydrogen in Europe: an update
4. Q & A

# Introduction to Delta-ee

## Research and consulting services for the energy transition

### Key facts:

Est. 2003

UK-based  
(Scotland)

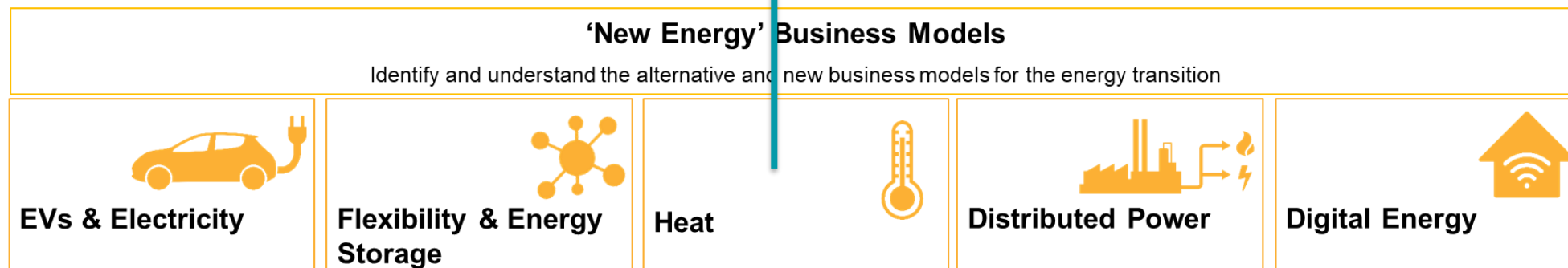
Sites across EU

Associates  
worldwide

11 subscription  
services

2x European Energy  
Summits per year

### Core competency areas:



**Delta-ee 'Gas Heating Service'**

**We help clients succeed in the transition from 'old' energy to 'new' energy.**

- |                       |                            |
|-----------------------|----------------------------|
| ■ Centralised →       | <b>Distributed</b>         |
| ■ Carbon intensive →  | <b>Low Carbon</b>          |
| ■ Commodity sales →   | <b>Service Orientated</b>  |
| ■ Meter points →      | <b>Customer Centric</b>    |
| ■ Value is upstream → | <b>Value is Downstream</b> |

### Selected clients:



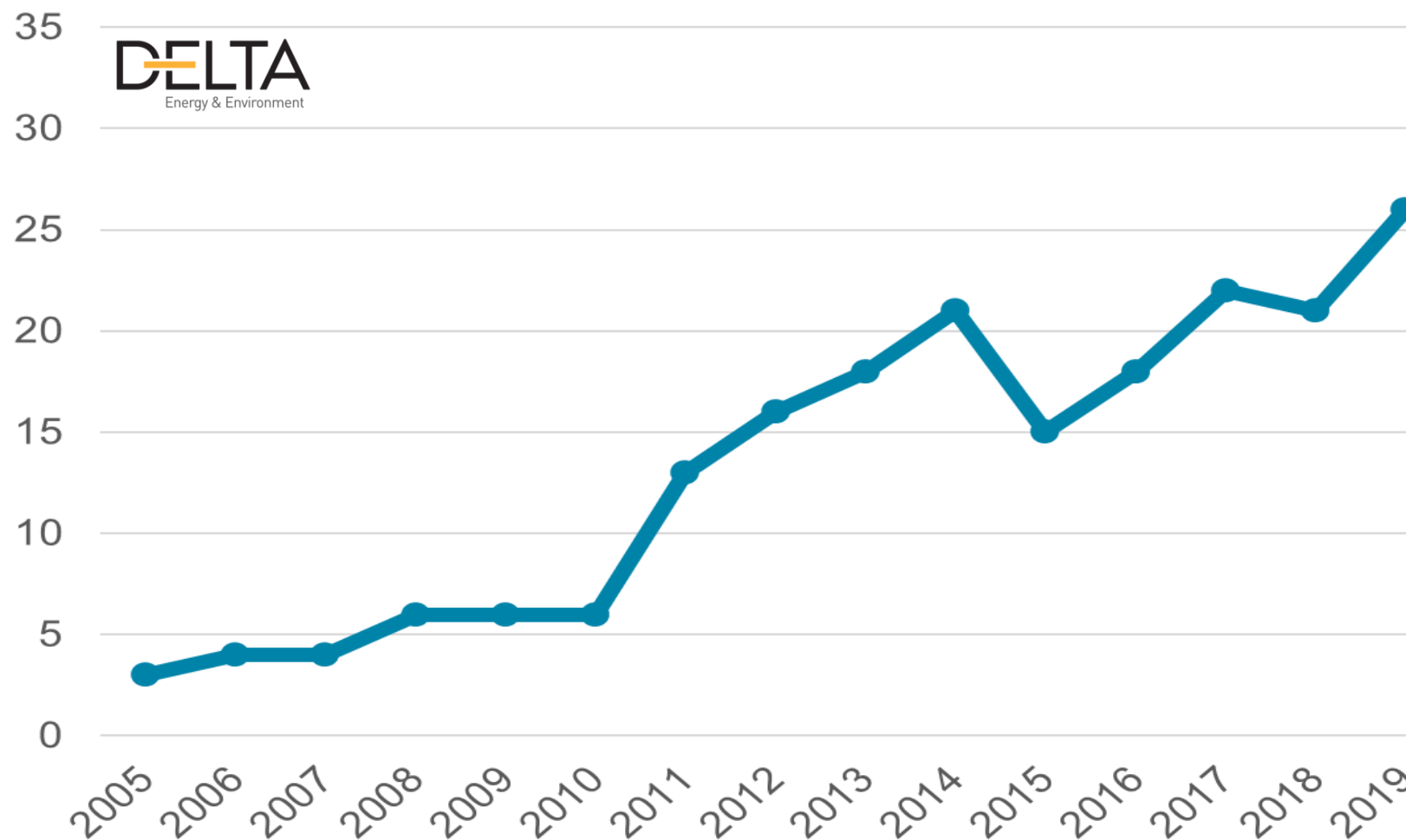
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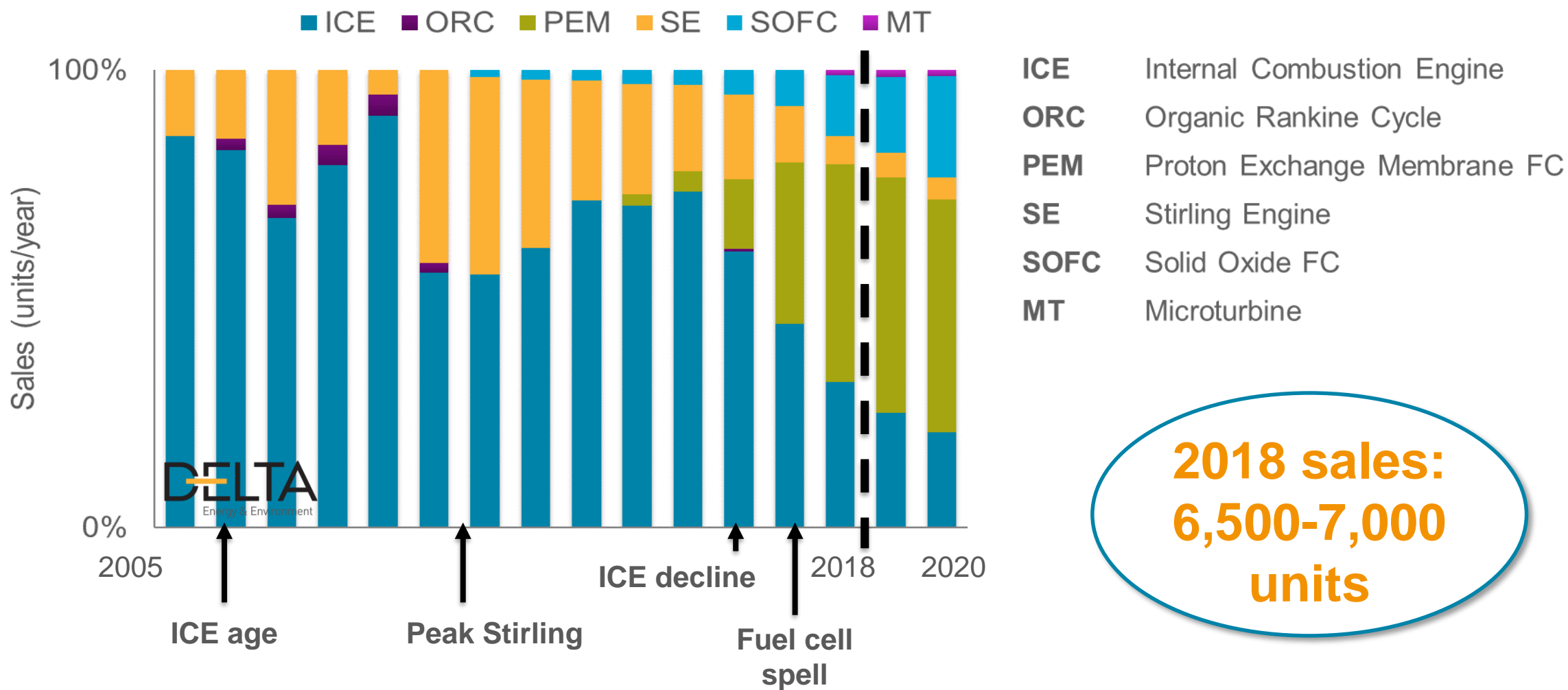
# We have been covering micro-CHP since 2004

Over this time, product availability has greatly improved



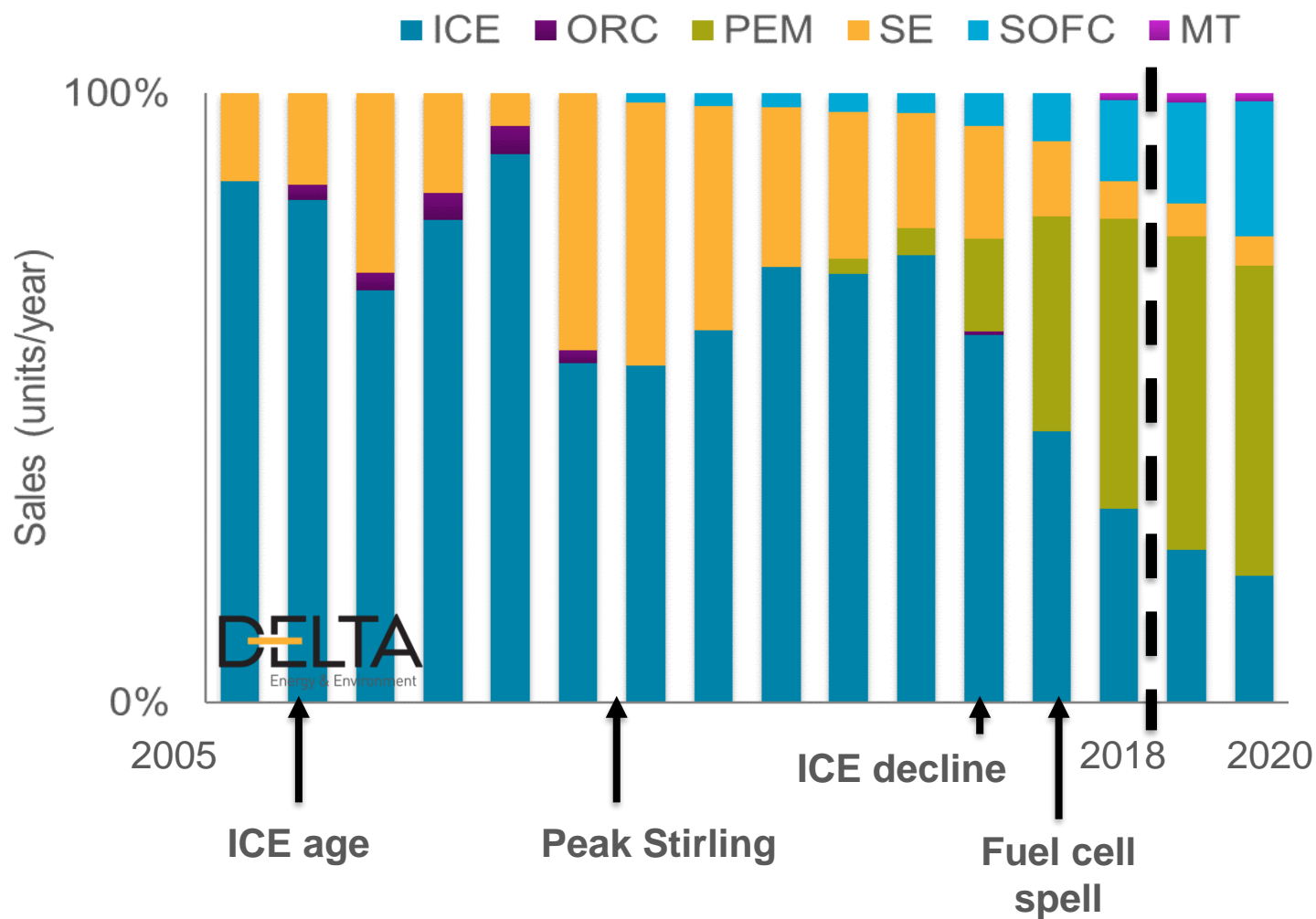
# The EU market has gone through several phases

Fuel cells (natural gas) are now the dominant technology



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Fuel cells (natural gas) are now the dominant technology



UK fuel cell micro-CHP players:

**VIESSMANN**

**Panasonic**



# Incentives drive sales – but these vary widely, affecting uptake

In most countries we see a shift towards tax-based mechanisms

- available
- withdrawn
- future uncertain

Incentive type:	Germany	UK	France	Belgium	Netherlands	Italy
National <u>grant</u>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>					<input checked="" type="checkbox"/>
State <u>grants</u>	<input checked="" type="checkbox"/>					
Regional <u>grants</u>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>   <input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Reduced <u>VAT</u>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
<u>VAT</u> rebate			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Low-interest <u>loans</u>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		
Net <u>metering</u>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Generation <u>tariff</u>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
Export <u>tariff</u>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
<u>Tariff</u> tax exemptions	<input checked="" type="checkbox"/>					
CHP / green / white <u>certificates</u>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>



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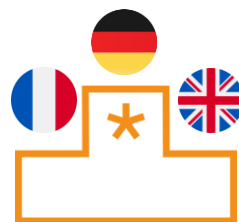
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# Europe's interest in hydrogen is growing

Germany is market leader; mobility and power-to-gas dominate

## Leading markets:

- Germany
- UK
- France
- Netherlands (emerging)



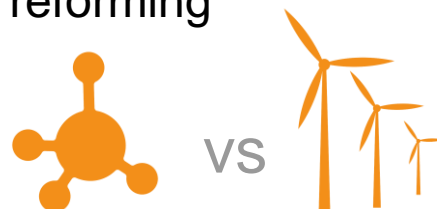
## Applications:

- Mobility
- Power-to-gas

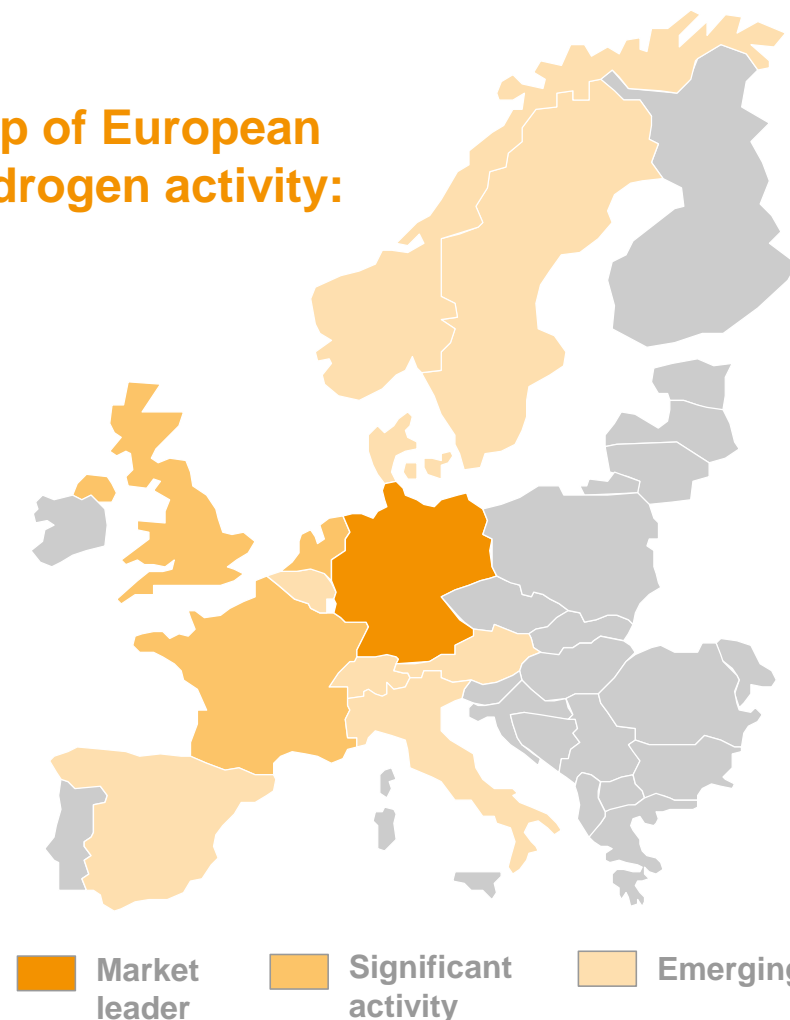


## Production:

- Steam methane reforming
- Electrolysis



## Map of European hydrogen activity:



# Key stakeholders in hydrogen development in Europe



## Technical support



## Oil & Gas



## Automotive



## Heating OEMs & fuel cell developers



## Electrolyser manufacturers

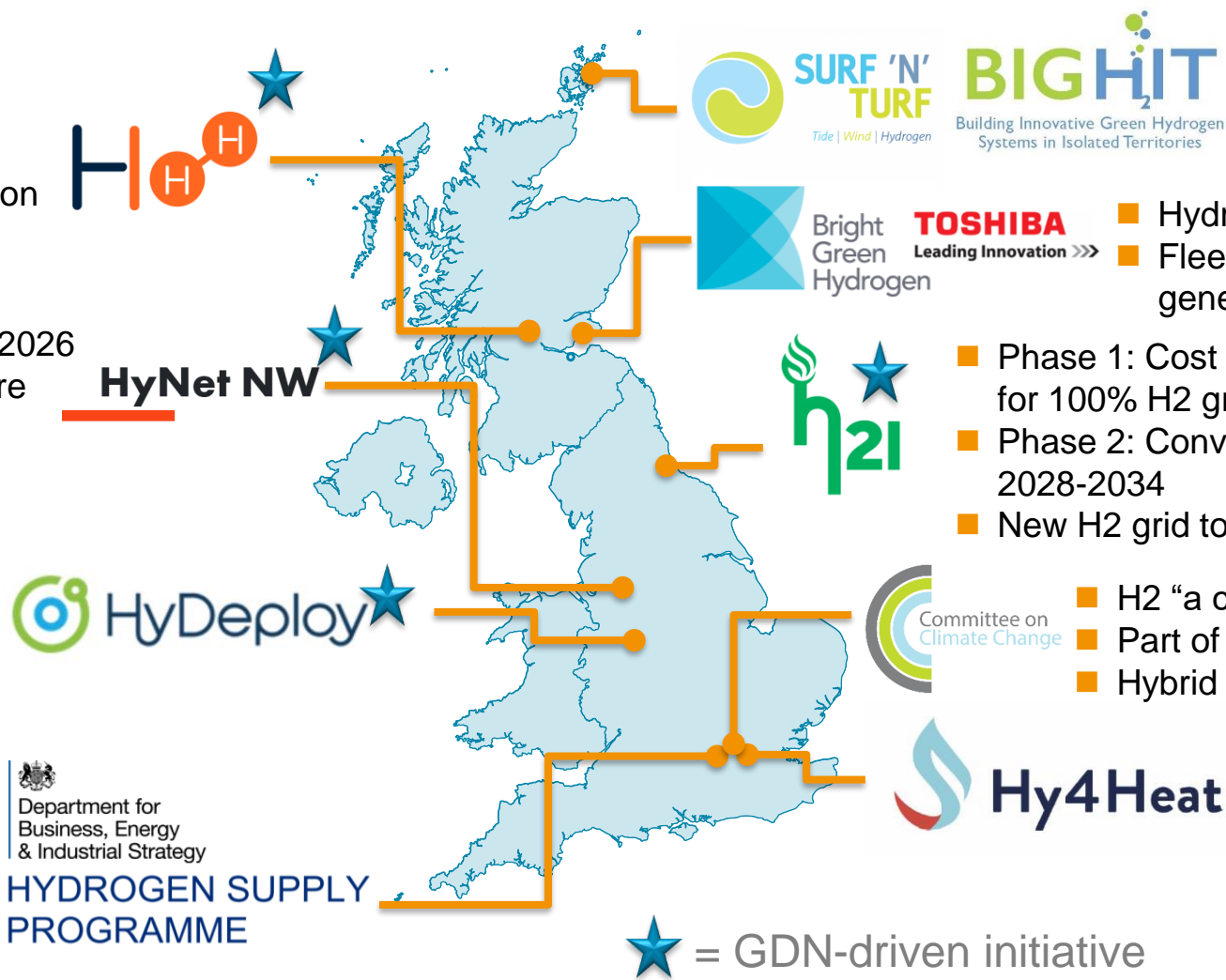


## Utilities



# Hydrogen as part of the UK solution

## Gas network companies have kick-started the movement



- Proof of concept plus + practical element
- Local generation + injection at 3 sites

- H2 regional system by 2026
- Produce, transport, store
- Blended grid injection

- 'H2 campus'
- 20% H2 blend
- live trial begins this summer

- £20M competition
- Bulk green H2 production
- Feasibility + demos

- Hydrogen island
- 'Windgas'
- Heat, power, vehicles

- Hydrogen local energy system
- Fleet refuelling, storage, power generation

- Phase 1: Cost and safety feasibility study for 100% H2 grid conversion
- Phase 2: Convert 3.7M homes between 2028-2034
- New H2 grid to satisfy 70% heat needs

- H2 "a credible option"
- Part of energy mix; H2 for back-up
- Hybrid hydrogen heat pumps

- £25M competition
- Develop 100% H2 appliances (heat & power)
- Unoccupied demo's by 2021

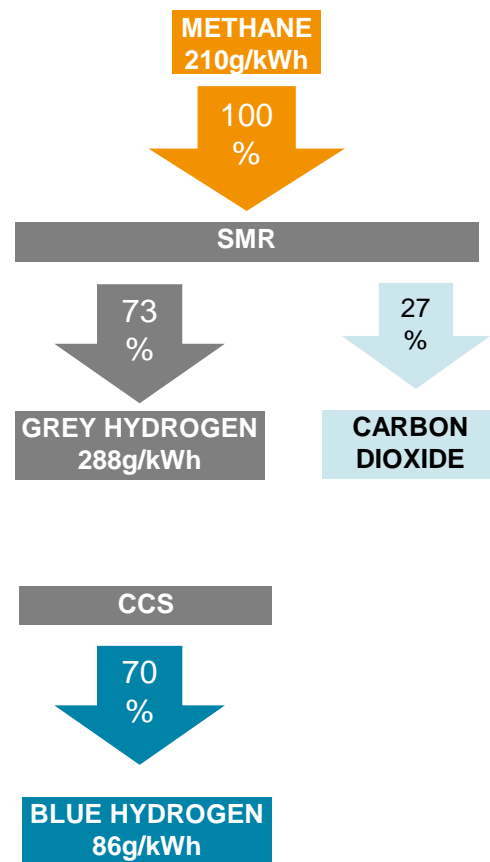
★ = GDN-driven initiative

# Hydrogen production and end-user costs

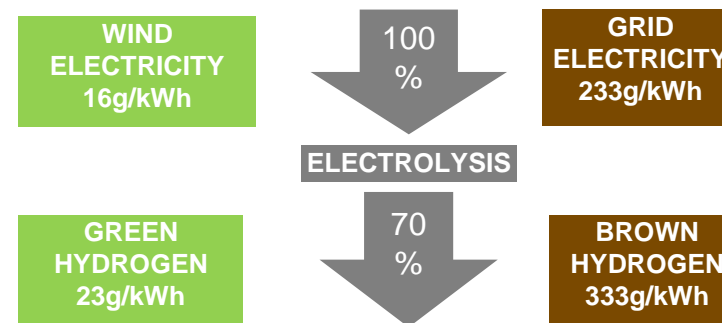
‘Green’ hydrogen expected to be cost-competitive by 2030



## Hydrogen from methane:



## Hydrogen from electrolysis:



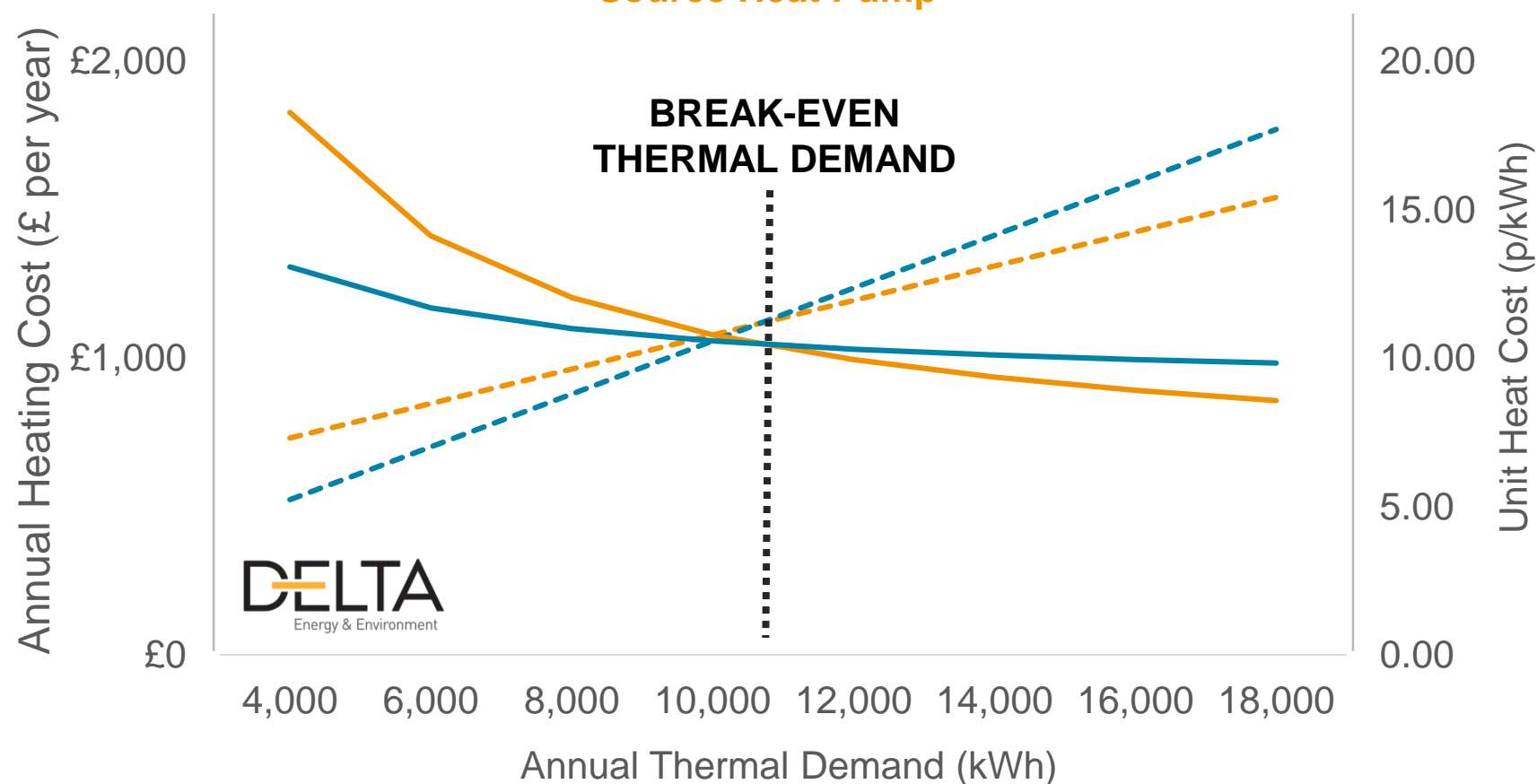
## End-user cost estimates:

- ‘Blue’ hydrogen = £2/kg H<sub>2</sub>, equivalent to £0.05p/kWh; retail price £0.09p/kWh.
- ‘Green’ hydrogen:
  - EU target cost = €3/kg by 2030.
  - IEA 2040 expected electricity production costs in favourable renewable locations: \$0.03/kWh -> \$2/kg or \$0.06/kWh H<sub>2</sub>.

# Hydrogen for heating

Hydrogen boilers are competitive for smaller homes, including most new-build properties, by 2030 (Delta-ee analysis; UK).

Costs for heating UK housing stock with H2 boiler vs. electric Air Source Heat Pump



# Find out more: Delta-ee Summits

Events looking at the future of energy on the customer side of the meter



## New Energy Summit

**28<sup>th</sup>-29<sup>th</sup> May 2019, Amsterdam, Netherlands**

*Exploring the transition from old to new energy*

- **Day 1:** Drill down into the new energy market
- **Evening 1:** Networking dinner & activity
- **Day 2:** Strategic issues, business models and joining the dots across the new energy space



## European Heat Summit

**25<sup>th</sup>-26<sup>th</sup> September 2019, London, UK**

*Debating how Europe will decarbonise heat*

- **Day 1:** Parallel roundtable discussions on electrification & high-efficiency gas markets
- **Evening 1:** Networking dinner & activity
- **Day 2:** Interactive plenary sessions exploring customers, business models, pathways

# Thank you for your attention

## Questions?

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